

CHAPTER 1 INTRODUCTION

1.1 Background

Currently, broiler chicken farm is growing very rapidly and spreading in almost all parts of Indonesia, both on large and small scale (Simanjuntak, 2018). The superiority of broiler chickens are their fast growth, efficient and affordable (Wahyuningrum *et al.*, 2018). Broiler chickens have weaknesses such as being easily stressed due to heat (Hastuti, 2017). Chickens are less tolerant of changes in environmental temperature where at higher ambient temperatures, chickens maintain their body temperature by releasing heat, causing this as one of the inhibiting factors for chicken production (Gunawan and Sihombing, 2004). This is because chickens are warm-blooded livestock whose body temperature is regulated within appropriate range (Tamzil, 2014).

The optimal temperature range for rearing broiler chickens is 23–24°C, while the environmental temperature in Indonesia, which has a tropical climate, is on average 27–28°C (Hidayah *et al.*, 2019). If chicken rearing is carried out above the optimal temperature range, livestock will suffer from stress because it is difficult to get rid of their body temperature into the environment. Chickens that are suffering from stress will reduce their feed consumption (Tamzil, 2014). Feed consumption will affect body weight gain because feed consumption determines the entry of nutrients into the body that are used for growth or development of new tissues (Daud *et al.*, 2017). The optimal broiler chicken productivity can be achieved through the use of feed additive (Samadi *et al.*, 2021).

Currently, there have been many developments by researchers using herbal plants as natural feed additives in poultry feed (Haroen and Budiansyah, 2019). The addition of plants in feed is able to help the digestive process, improve chicken performance, increase feed utilization, maintain health, reduce the adverse effects of environmental stress and is considered safe, cost-effective and environmentally friendly without side effects (Vinus *et al.*, 2018). This is because herbal plants have phytochemical compounds that play role in supporting livestock productivity and health (Nurmeiliasari *et al.*, 2020).

Meniran (*Phyllanthus niruri* linn) is herbal plant that contains phytochemical compounds such as flavonoids and saponins (Sidik and Subarnas, 1993 in Hariyani, 2015). Flavonoid in meniran (*Phyllanthus niruri* linn) plant has function as immunomodulator (Sabdoningrum *et al.*, 2020). Immunomodulator play role in helping optimize and improve immune system function by stimulating (immunostimulants) or suppressing abnormal immune reactions (immunosuppressants) (Suhirman and Winarti, 2010). Immunomodulator causes the increase in the performance of immune cells so an increase in body endurance is followed by an increase in appetite (Astuti *et al.*, 2017). Flavonoid and saponin compounds are able to increase broiler chicken body weight gain due to the increase of body health and feed substances absorption through increased intestinal mucosal permeability (Tribudi *et al.*, 2020).

Saponins are phytochemical compounds that can increase growth rate and better feed efficiency. Saponins are able to increase the diameter of villi and increase the permeability of the intestinal cell wall thereby increasing the

absorption of nutrients from feed and in low levels it can increase the transport of nutrients between cells (Chaudhary *et al.*, 2018; Irwani and Candra, 2016; Bintang *et al.*, 2007).

Obstacle in the application of plant extracts is the low solubility in digestive tract so the absorption of phytochemicals in blood plasma is low (Zhang *et al.*, 2013). At normal size, only a small amount of drug compounds are able to reach the target site of action so the efficiency of drug use is hampered (Kurniasari and Atun, 2017). One of alternative solutions to this problem is to make plant extract in the form of nanoparticles (Devi *et al.*, 2015). The reduction of substance's particle size into nanoparticles increases the surface area and solubility of the substance so bioavailability, efficacy and therapeutic effect also increase (Laili *et al.*, 2014). This allows the increase in solubility of phytochemicals in meniran (*Phyllanthus niruri* Linn) extract which is beneficial for increasing feed use and livestock growth.

Feed conversion ratio is a parameter to determine the efficiency level of feed use and is one of the standards in production (Putri and Bintari, 2021; Widiati, 2021). Feed conversion ratio is a measure of how well chickens convert feed use into body weight (Syaifullah, 2019). Determination of feed conversion ratio is done by calculating the ratio between the amount of feed consumption and body weight gain (Purba and Ketaren, 2011). The smaller the feed conversion ratio value, the better because the smaller the feed conversion ratio, the better the efficiency of feed use (Wawan, 2010 in Widiati, 2021).

Based on the statement above, it is necessary to conduct research to determine the effectiveness of meniran (*Phyllanthus niruri* Linn) extract nanoparticles on feed consumption, body weight gain and feed conversion ratio of broiler chicken.

1.2 Problem Statement

1. Can meniran (*Phyllanthus niruri* Linn) extract nanoparticles increase feed consumption of broiler chicken?
2. Can meniran (*Phyllanthus niruri* Linn) extract nanoparticles increase body weight gain of broiler chicken?
3. Can meniran (*Phyllanthus niruri* Linn) extract nanoparticles decrease feed conversion ratio of broiler chicken?

1.3 Theoretical Foundation or Basis

Broiler chickens are warm-blooded animals whose body temperature is regulated with an appropriate range (Sebayang *et al.*, 2016). The optimal temperature range for rearing broiler chickens is 23–24°C, while the environmental temperature in Indonesia, which has a tropical climate, is 27–28°C (Hidayah *et al.*, 2019). Rearing chickens in an environment that is higher than the optimum range will make broiler chickens prone to stress (Rini *et al.*, 2019).

Stress in livestock causes decrease in feed consumption (Tamzil, 2014). Decreased feed consumption causes body weight loss due to lack of nutrient intake for the development of new tissues so the growth is disrupted (Sandana *et al.*, 2020; Hidayah *et al.*, 2019; Daud *et al.*, 2017). Feed additives are commonly used to increase and improve the growth or productivity of poultry (Sinurat *et al.*, 2003).

Meniran (*Phyllanthus niruri* Linn) is a plant that has the potential as feed additive (Lestariningsih *et al.*, 2015). Meniran (*Phyllanthus niruri* Linn) contains beneficial phytochemical compounds such as flavonoids and saponins (Zalizar, 2013). Flavonoids are phytochemical compounds that have biological benefit for livestock health (Tohge *et al.*, 2018). The immunomodulatory activity of flavonoids causes the increase in the performance of immune cells so body endurance increases (Astuti *et al.*, 2017). The increase of body endurance causes the productivity of poultry to also increase (Lestariningsih and Putra, 2021).

Saponins are able to increase the diameter of intestinal villi and the permeability of intestinal mucosa, thereby helping the process of feed nutrients absorption, enabling a better growth rate and feed use efficiency (Chaudhary *et al.*, 2018). Nutrients from feed that are well absorbed are utilized by chickens for tissue growth (Astuti *et al.*, 2015). The absorption of phytochemical compounds in plant extracts is generally not optimal due to the low solubility and bioavailability of the extract (Zhang *et al.*, 2013). One of solutions to this problem is to make extract in the form of nanoparticles (Devi *et al.*, 2015).

Nanoparticles cause an increase in surface area and solubility of substances so the bioavailability, efficacy and therapeutic effects also increase (Laili *et al.*, 2014). Being nano-sized, the compounds are easily absorbed by cells (Patra *et al.*, 2018). Nutrient absorption is directly proportional to the feed use efficiency so that good nutrient absorption results in good feed use efficiency (Srihartati and Sukirno, 2003 in Shofura *et al.*, 2017).

The level of feed use efficiency is known through the feed conversion ratio value (Subekti, 2012). Feed conversion ratio is obtained by dividing the amount of feed consumption with body weight gain (Putri and Bintari, 2021). Feed consumption is the amount of feed consumed by livestock in a certain period of time, while body weight gain is the difference between body weight at a certain time and initial body weight (Alam, 2021; Rasyaf, 2011).

1.4 Aim of Research

1.4.1 General Aim

The general aim of this study was to determine the effectiveness of meniran (*Phyllanthus niruri* Linn) extract nanoparticles on performance of broiler chicken.

1.4.2 Specific Aim

The specific aim of this research are:

1. Knowing the effectiveness of meniran (*Phyllanthus niruri* Linn) extract nanoparticles on feed consumption of broiler chicken.
2. Knowing the effectiveness of meniran (*Phyllanthus niruri* Linn) extract nanoparticles on body weight gain of broiler chicken.
3. Knowing the effectiveness of meniran (*Phyllanthus niruri* Linn) extract nanoparticles on feed conversion ratio of broiler chicken.

1.5 Benefits of Research Result

1.5.1 Theoretical Benefit

The result of this research is expected to provide information on the effectiveness of meniran (*Phyllanthus niruri* Linn) extract nanoparticles on feed consumption, body weight gain and feed conversion ratio of broiler chicken.

1. 5. 2 Practical Benefit

This finding can be used by farmer for the development of herbal plants in the form of meniran (*Phyllanthus niruri* Linn) extract nanoparticles which have effectiveness on feed consumption, body weight gain and feed conversion ratio of broiler chicken.

1.6 Hypothesis

1. Meniran (*Phyllanthus niruri* Linn) extract nanoparticles can increase feed consumption of broiler chicken.
2. Meniran (*Phyllanthus niruri* Linn) extract nanoparticles can increase body weight gain of broiler chicken.
3. Meniran (*Phyllanthus niruri* Linn) extract nanoparticles can decrease feed conversion ratio of broiler chicken.